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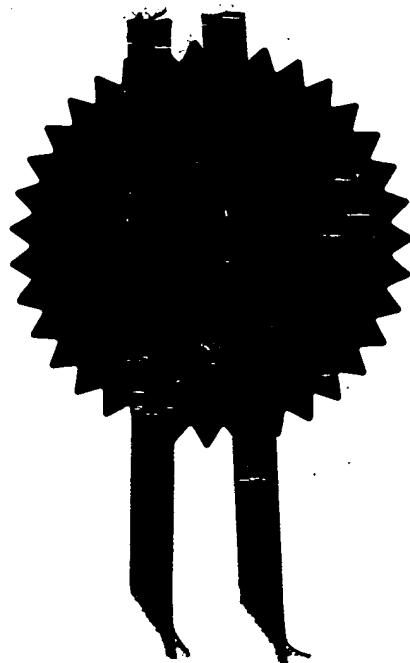
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Barker Brettell 04 October 1999

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr. D.A. Wightman Tel: 0121 456 1364

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IMPROVEMENTS IN OR RELATING TO FLUID SEALS

This invention concerns improvements in or relating to fluid seals. The invention has particular application to fluid seals for sealing joints

5 between two components connected together in a fluid line, for example between two pipes, or between a pipe and another fitting or between two fittings such as a hydraulic block to which one or more parts may be attached, for example a pump or valve application.

10 It is already well known in the water and automotive industries to provide sealing rings for sealing joints between two components in a fluid line. The sealing rings may be made of rubber or plastics compatible with the fluid to be transmitted in the fluid line, for example water, oil, petrol, solvents.

15

For many applications, it is desirable to remove any solid particles present in the fluid to prevent damage to equipment connected to the fluid line. For this purpose, it is common to fit a filter in the fluid line, for example a metal or plastics mesh screen having a mesh rating to remove 20 solid particles above a given size.

For convenience, the mesh screen may be fitted at a joint between two components in the fluid line. This can complicate the provision of an adequate seal. In addition, fitting separate seal and filter elements adds to 25 material costs and installation costs. Also, there is a risk of joints being assembled without the filter resulting in damage to equipment connected in the fluid line.

The present invention has been made from a consideration of the problems 30 and disadvantages aforementioned.

According to a first aspect of the present invention there is provided an integral seal and filter for a fluid line.

- 5 By this invention the seal and filter are combined in a unitary construction capable of sealing a joint between two components in a fluid line and filtering fluid in the fluid line. In this way, supply and installation of separate seal and filter elements is avoided.
- 10 Preferably, the seal is bonded to the peripheral edge of the filter. For example, the filter may comprise a mesh screen with the peripheral edge embedded in the seal. In this way, the material of the seal penetrates the interstices of the mesh so as to become mechanically bonded through the mesh.
- 15 Advantageously, the mesh is deformed by crushing a narrow region of the mesh inwardly of the peripheral edge to form a crease blocking the interstices and restricting flow of the seal material from the peripheral edge region towards the centre region of the mesh. In this way, only the peripheral edge region is embedded in the seal material and the centre region is left free to provide the filtering function.
- 20

The mesh screen may be made of metal, for example stainless steel, aluminium or brass. Alternatively, the mesh screen may be made of plastics. The mesh can be of any size for the filter rating required for a particular application.

The seal may be made of elastomer, for example rubber such as nitrile rubber, hydrogenated nitrile rubber, ethylene propylene diene monomer, fluorocarbons, polyacrylic, neoprene, fluorosilicon, or other suitable

compounds for the intended application. Alternatively, the seal may be made of plastics. The seal material is chosen to be compatible with the fluid in the fluid line.

5 The combined seal and filter can be of any size and shape to suit a given application, for example circular, oval, rectangular, or other polygonal shape. As will be appreciated, by providing an integral seal and filter, the filter can be made to any shape and the seal configured to this shape by attaching to the filter. In this way, both simple and complex seal 10 shapes can be produced and maintained for any desired application.

The provision of the filter as an integral part of the seal provides a degree of reinforcement for the seal at fluid pressures up to 250 bar but additional reinforcement may be required for applications involving higher 15 fluid pressures.

For such high pressure applications, the seal and filter is preferably provided with an outer support member, for example a plate to which the seal is bonded to form a unitary construction.

20 Advantageously, the plate has a hole with a counterbore providing a shoulder for locating the peripheral edge of the filter with the seal encapsulating the peripheral edge and bonded to the marginal edge of the hole.

25 Preferably, the seal projects outwardly from the plate on both sides for sealing engagement with the components of the joint to be sealed. The plate may act as a spacer to limit the compression of the seal.

The plate may be made of metal, for example zinc plated steel or stainless steel. Alternatively, the plate may be made of plastics, for example polycarbonate.

5 According to a second aspect of the present invention there is provided a joint between opposed faces of first and second components in a fluid line comprising a seal arranged between the opposed faces of the components and a filter integral with the seal and arranged to extend across the fluid line.

10

The two components may be pipes having opposed end flanges with the seal arranged between the flanges so as to be compressed when the flanges are urged axially towards each other. One of the flanges may have a recess in the end face in which the seal is positioned to limit compression of the seal.

15

Alternatively, one of the components may be a pipe and the other component a fitting to which the pipe is attached.

20 Other arrangements are possible, for example a block for one or more fluid lines to which fittings are attached, for example a pump or valve, with the seal arranged between the block and the fitting.

25 According to a third aspect of the invention there is provided a method of forming an integral seal and filter comprising providing a filter and bonding a seal to the marginal edge of the filter.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, wherein:-

30

Figure 1 is an end view of a combined seal and filter embodying the invention;

5 **Figure 2** is a section of a joint incorporating the seal and filter of Figure 1;

Figure 3 is a section of an alternative joint incorporating the seal and filter of Figure 1;

10 **Figure 4** is an end view of an alternative combined seal and filter embodying the invention;

Figure 5 is a section on the line 5-5 of Figure 4;

15 **Figure 6** is a section of a joint similar to Figure 2 incorporating the seal and filter of Figures 4 and 5;

Figure 7 is a section of a joint similar to figure 3 incorporating the seal and filter of Figures 4 and 5;

20 **Figure 8** is an end view of another combined seal and filter embodying the invention; and

Figure 9 is a section on the line 9-9 of Figure 8.

25 In the following description of exemplary embodiments of the invention, like reference numerals are used throughout to indicate the same or similar components in each embodiment.

Referring first to Figure 1, there is shown a combined seal 1 and filter 2 comprising a seal ring 3 and a wire mesh screen 4.

The seal ring 3 is made of rubber or any other suitable elastomer for the

5 intended application moulded directly onto the peripheral edge region of the screen 4. In this embodiment, the seal ring 3 is an O-ring of circular cross-section but this is not essential and other cross-sections may be employed, for example oval, rectangular, trapezoidal.

10 The screen 4 is made of metal, for example stainless steel or brass, and has a mesh size for the intended application. The screen 4 is embedded around the peripheral edge region in the elastomer of the seal ring 3 by locating in a mould cavity and injecting rubber into the cavity. In this embodiment, the filter 2 is formed by blanking out the mesh screen 4

15 from a flat sheet of mesh.

The mesh is crushed over a narrow area inside the peripheral edge region covered by the seal ring 3 so as to form a crease line blocking the interstices and prevent the elastomer flowing into the central region of the

20 screen 4 serving as the filter 2.

As will be appreciated the elastomer of the seal ring 3 flows into and through the interstices of the mesh 4 in the peripheral edge region so as to bond to the mesh forming a unitary construction in which the seal 1 and

25 filter 2 are integral.

Referring now to Figure 2, there is shown a joint 5 between two pipes 6, 7 in a fluid line, for example a water supply line for drinking water, cooling systems etc.

Each pipe 6, 7 has an external flange 8, 9 respectively. An end face of one flange 8 is formed with an annular recess 10 in which the combined seal 1 and filter 2 is located. The face of the other flange 9 is flat. The depth of the recess 10 is less than the diameter of the seal ring 3 so that

5 the seal ring 3 is compressed when the end faces of the flanges 8, 9 are drawn together by clamping means to provide a fluid-tight seal between the flanges 8, 9.

The clamping means comprises a pair of rings 11, 12 that fit over the

10 pipes 6, 7 respectively and seat against the flanges 8, 9 respectively. One of the rings 11 has an external screw threaded portion 13 and the other ring 12 has an internal screw threaded portion 14. The screw-threaded portions 13, 14 are engageable so that tightening the outer ring 12 on the inner ring 11 urges the pipes 6, 7 towards each other to seal the joint 5.

15

The mesh screen 4 extends across the passageway through the pipes 6, 7 so that solid particles contained in a fluid flowing through the passageway of a size that exceeds the mesh rating are removed.

20 As will be appreciated combining the seal and filter 2 in a single component reduces from two to one the number of components to be purchased and installed with potential savings in both material costs and installation costs.

25 Furthermore, removal of the combined seal 1 and filter 2 for cleaning, repair and replacement is facilitated offering additional potential savings in maintenance costs.

Referring now to Figure 3, there is shown an alternative application of the

30 combined seal 1 and filter 2 for sealing a valve body 15 to a block 16, for

example in hydraulic units. The body 15 may be secured to the block 16 by any suitable means such as threaded bolts (not shown) engaging tapped holes (not shown) in the block 16 to connect respective bores 17, 18 in the body 15 and block 16.

5

As shown, the block 16 has a planar mounting surface 19 and the body 15 has an attachment surface 20 with a recess 21 in which the combined seal 1 and filter 2 is located. The depth of the recess 21 is such that the seal ring 3 is compressed to seal the joint between the body 15 and block 16.

10 The filter 2 extends across the passageway formed by the bores 17, 18 through the body 15 and block 16 so that solid particles contained in a fluid flowing through the passageway of a size that exceeds the mesh rating are removed.

15 The combined seal 1 and filter 2 above-described is suitable for low pressure applications in which the fluid pressure is less than 250 bar. At higher pressures, there is a risk of the seal 1 and filter 2 deforming sufficiently for the seal 1 to extrude itself out of the gap in which it is located between the two components forming the joint to be sealed.

20

Referring now to Figures 4 and 5, there is shown a modification of the combined seal 1 and filter 2 which is capable of withstanding higher fluid pressures.

25 In this modification, the seal 1 and filter 2 is reinforced to prevent the seal 1 extruding itself out of the gap between the two components of the joint by means of an external support comprising a flat, annular plate 22. In this embodiment the plate is made of metal, for example stainless steel or brass but this is not essential and other materials including plastics may
30 be used.

The plate 22 has a stepped central hole 23 providing an abutment shoulder 24 for the peripheral edge of the mesh screen 4 of the filter 2.

5 The combined seal 1 and filter 2 is secured by embedding the peripheral edge of the mesh screen 4 in the seal ring 3 and bonding the seal ring 3 to the internal marginal edge of the hole 23.

As shown, the seal ring 3 has a generally trapezoidal cross-section with
10 side edges 25, 26 angled so that the seal 1 projects on either side of the plate 22.

The reinforced seal 1 and filter 2 is made by blanking out the mesh screen 4 from a sheet of mesh of the required mesh size and crushing a
15 narrow area of the mesh screen 4 to form a crease line inside the outer peripheral region to be embedded in the seal ring 3.

The plate 22 is formed by pressing from a flat sheet of metal of the required thickness and a chemical bonding agent applied to the inner
20 peripheral edge of the hole 23.

The plate 22 with the mesh screen 4 received in the hole 23 against the shoulder 24 is then positioned in a mould cavity and the elastomer injected into the cavity to form the seal ring 3.

25 To assist flow of elastomer in the cavity, the plate 22 is formed with two diametrically opposed notches 27, 28 in the marginal edge of the hole 23 which allow the elastomer to flow to either side of the mesh screen 4 within the cavity to form the seal ring 3. The number and arrangement of
30 notches 27, 28 may be altered as desired. An even number of notches, for

example 2,4,6,8 etc, arranged in pairs is preferred but this is not essential.

5 The elastomer is allowed to cure in the mould and then the mould is opened to remove the fully bonded assembly of the seal 1 and filter 2 within the plate 22.

10 Figures 6 and 7 show the application of the reinforced seal 1 and filter 2 of Figures 4 and 5 for sealing the joints between two pipes 6, 7 (Figure 6) and between a valve body 15 and a block 16 (Figure 7) similar to the arrangements shown in Figures 2 and 3.

15 As shown in Figure 6, the seal 1 and plate 22 are positioned between planar end faces of the flanges 8, 9 and the plate 22 acts as a spacer to limit compression of the side edges 25, 26 of the seal 1 to seal the joint between the pipes 6, 7 when the clamping rings 11, 12 are tightened to urge the flanges 8, 9 towards each other.

20 The diameter of the plate 22 is similar to the diameter of the flanges 8, 9 so that the seal 1 and filter 2 is centred between the flanges 8, 9 by the inner clamping ring 11. Alternatively, the plate 22 could be of smaller diameter received in a recess in an end face of one of the flanges 8, 9.

25 As shown in Figure 7, the valve body 15 has a recess 21 sized to receive the plate 22 and of a depth substantially the same as the thickness of the plate 22 so that the side edges 25, 26 of the seal 1 are compressed to seal the joint when the body 15 is secured to the block 16.

30 As will be appreciated, securing the seal ring 3 to the plate 22 reinforces the seal ring 3 enabling the seal 1 to withstand substantially higher

pressures without extruding out of the area between the two components of the joint to be sealed.

Referring now to Figures 8 and 9, these show two examples of a 5 combined seal 1 and filter 2 in a common support plate 22 for sealing two joints. As shown, one seal 1 and filter 2 is of L-shape and the other is of rectangular shape with the plate 22 having holes 23 of matching shape. The materials and method of forming each seal 1 and filter 2 are similar 10 to the previously described embodiments. Other shapes of seal 1 and filter 2 and/or plate 22 may be employed to suit the joint to be sealed. By providing more than one seal 1 and filter 2 in a common plate 22, several joints can be sealed using a single component thereby facilitating installation, for example when connecting a number of fittings to a hydraulic block.

15

It will be understood that the invention is not limited to the embodiments above-described. For example, the seal 1 may be made of any suitable elastomer or resilient plastics capable of sealing when compressed. The seal ring 3 may be of circular or non-circular cross-section. The filter 2 20 may be made of metal or plastics and the centre region may be flat or dome-shaped to increase the area of the filter.

The combined seal 1 and filter 2 may be of annular shape or any other suitable shape, for example oval, elliptical, rectangular, L-shape, T-shape 25 or the like depending on the cross-section of the passageway to be sealed.

Where provided, the support plate 22 may be made of metal or plastics and may be flat or any other suitable shape for locating between the opposed faces of the components forming the joint to be sealed. The 30 support plate 22 may be of annular shape or any other suitable shape.

More than one seal 1 and filter 2 may be provided in the same support plate 22 depending on the number and arrangement of the joints to be sealed.

5

Other modifications will be apparent to those of ordinary skill in the art and are deemed within the scope of the invention.

CLAIMS

1. An integral seal and filter for a fluid line.

5

2. An integral seal and filter according to claim 1 wherein the seal is bonded to the peripheral edge of the filter.

10 3. An integral seal and filter according to claim 1 or claim 2 wherein the filter comprises a mesh screen with the peripheral edge embedded in the seal.

15 4. An integral seal and filter according to claim 3 wherein the mesh is deformed by crushing a narrow region of the mesh inwardly of the peripheral edge to form a crease for confining the seal to the peripheral edge region of the mesh.

5. An integral seal and filter according to claim 3 or claim 4 wherein the mesh screen is made of metal.

20

6. An integral seal and filter according to claim 5 wherein the mesh screen is made of stainless steel, aluminium or brass.

25 7. An integral seal and filter according to claim 5 wherein the mesh screen is made of plastics.

8. An integral seal and filter according to any one of the preceding claims wherein the seal is made of elastomer or plastics.

9. An integral seal and filter according to claim 8 wherein the seal is made of rubber.

10. An integral seal and filter according to claim 8 or claim 9 wherein the seal is made of nitrile rubber, hydrogenated nitrile rubber, ethylene propylene diene monomer, fluorocarbon, fluorosilicon, polyacrylic or neoprene.

11. An integral seal and filter according to any one of the preceding claims wherein the seal is of circular, oval, or elliptical cross-section.

12. An integral seal according to any one of claims 1 to 10 wherein the seal is of rectangular, trapezoidal or other polygonal cross-section.

13. An integral seal and filter according to any one of the preceding claims wherein the filter is substantially flat.

14. An integral seal and filter according to any one of claims 1 to 12 wherein the filter is dome-shaped.

15. An integral seal and filter according to any one of the preceding claims wherein an outer support member is provided.

16. An integral seal and filter according to claim 15 wherein the outer support member comprises a plate having a hole in which the seal and filter is positioned.

17. An integral seal and filter according to claim 16 wherein the seal is bonded to the marginal edge of the hole.

18. An integral seal and filter according to claim 16 or claim 17 wherein the hole has a counterbore providing a shoulder for locating the peripheral edge of the filter with the seal encapsulating the peripheral edge and bonded to the marginal edge of the hole.

5

19. An integral seal and filter according to any one of claims 16 to 18 wherein the seal projects outwardly from the plate on both sides.

20. An integral seal and filter according to any one of claims 16 to 19
10 wherein the plate is made of metal or plastics.

21. An integral seal and filter according to any one of the preceding claims wherein the plate has a plurality of holes with a separate seal and filter in each hole.

15

22. An integral seal and filter substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

23. An integral seal and filter substantially as hereinbefore described
20 with reference to Figures 4 and 5 of the accompanying drawings.

24. An integral seal and filter substantially as hereinbefore described with reference to Figures 8 and 9 of the accompanying drawings.

25. 25. A joint between opposed faces of first and second components in a fluid line comprising a seal arranged between the opposed faces of the components and a filter integral with the seal and arranged to extend across the fluid line.

26. A joint according to claim 25 wherein the two components comprise pipes having opposed end flanges with the seal arranged between the flanges so as to be compressed when the flanges are urged axially towards each other.

5

27. A joint according to claim 25 wherein one of the components is a pipe and the other component is attached to the pipe.

10 28. A joint according to claim 25 wherein one of the components is a block and the other component is attached to the block.

29. A joint according to any one of claims 25 to 28 wherein one of the opposed faces has a recess in which the seal is positioned to limit compression of the seal.

15

30. A joint substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

20 31. A joint substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

32. A joint substantially as hereinbefore described with reference to Figure 6 of the accompanying drawings.

25 33. A joint substantially as hereinbefore described with reference to Figure 7 of the accompanying drawings.

30 34. A method of forming an integral seal and filter comprising providing a filter and bonding a seal to a marginal edge portion of the filter.

35. A method according to claim 34 wherein the filter is a mesh screen and the seal is bonded through the mesh screen.

5 36. A method according to claim 34 or claim 35 wherein a support plate is provided having a hole and the seal is bonded to the marginal edge of the hole.

10 37. A method of forming an integral seal and filter substantially as hereinbefore described with reference to Figure 1 or Figures 4 and 5 or Figures 8 and 9 of the accompanying drawings.

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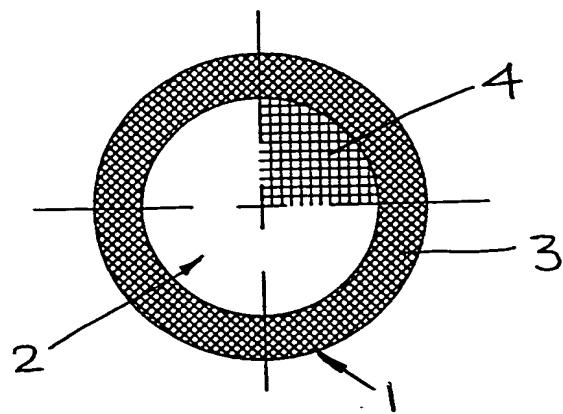


FIGURE 1.

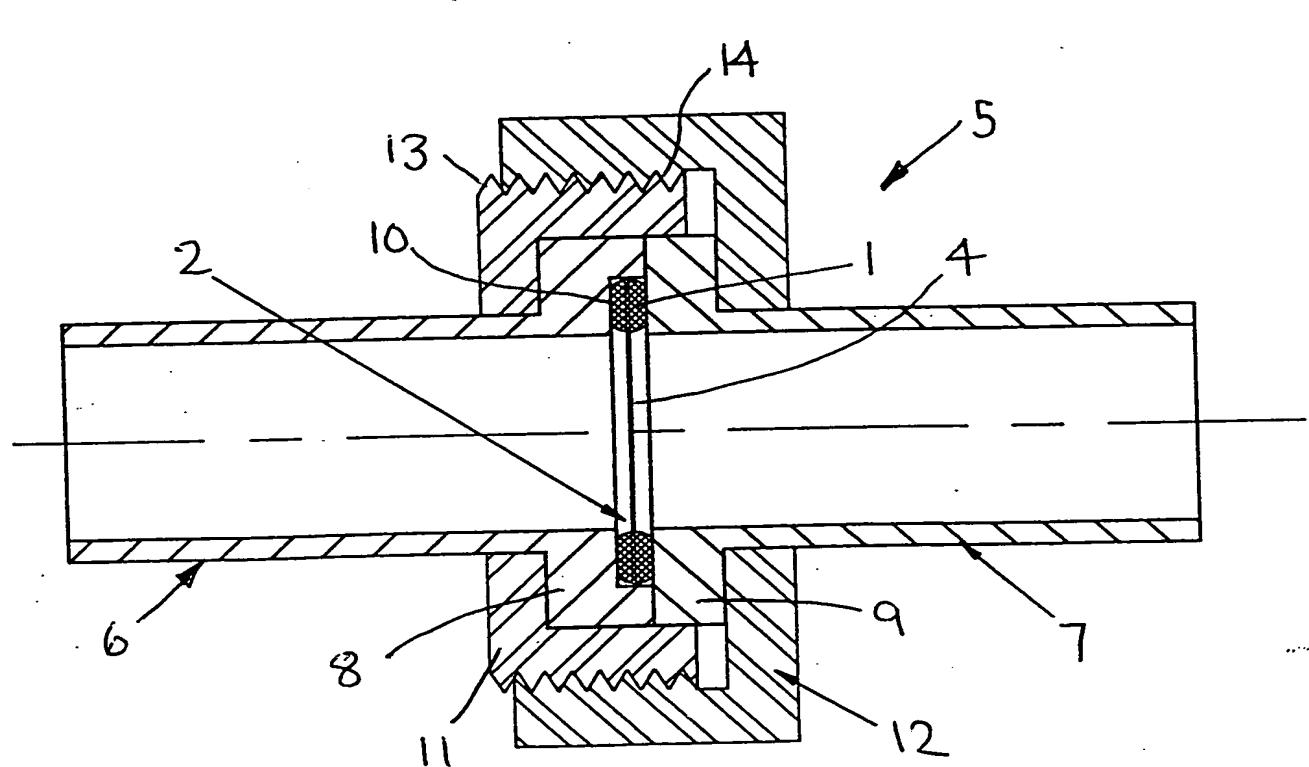


FIGURE 2.

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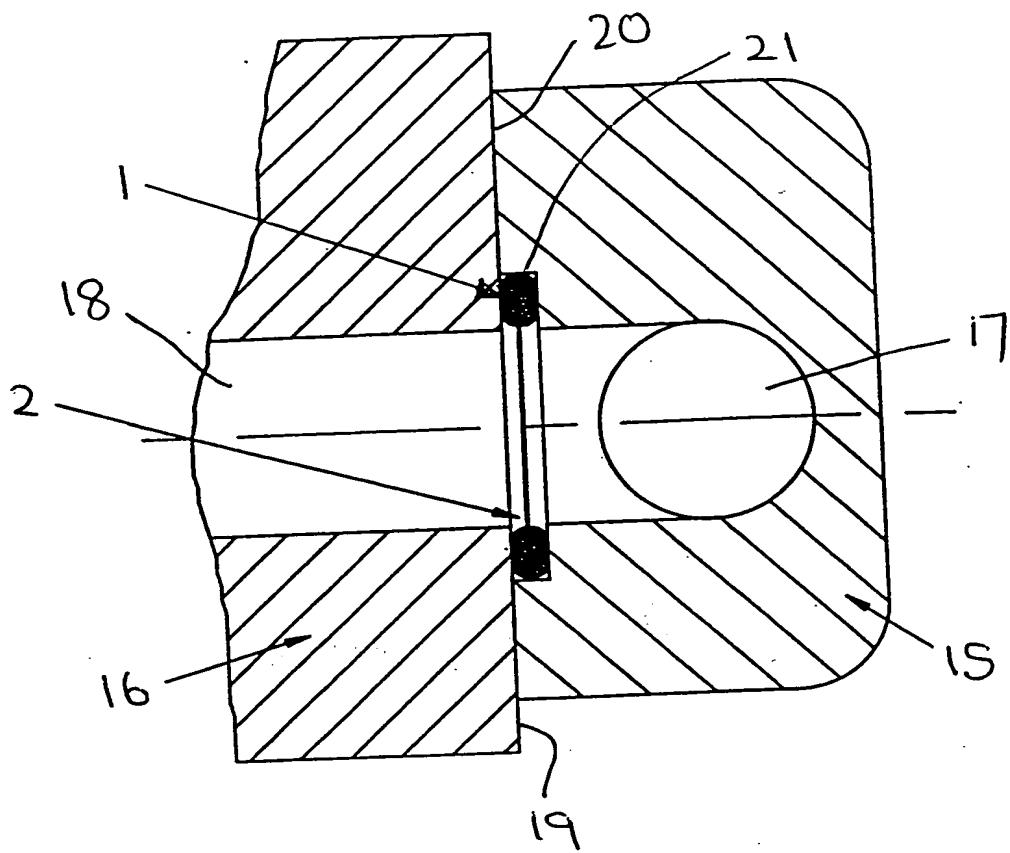


FIGURE 3

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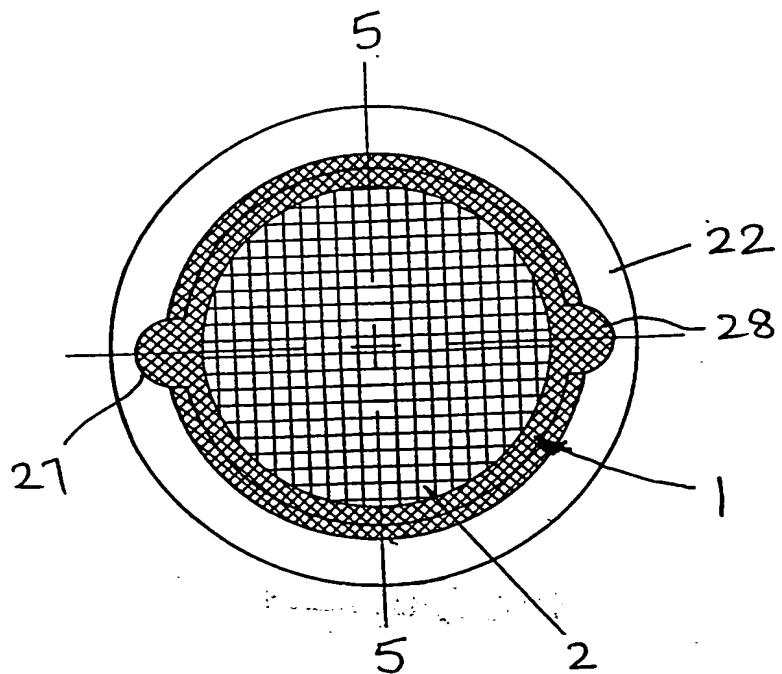


FIGURE 4

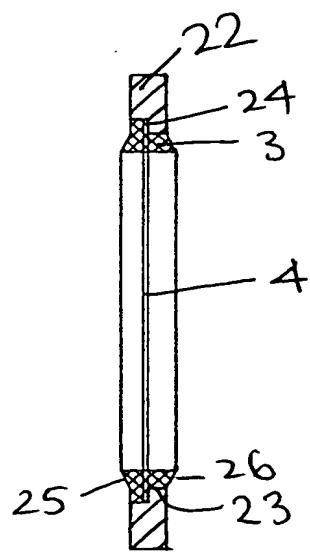


FIGURE 5

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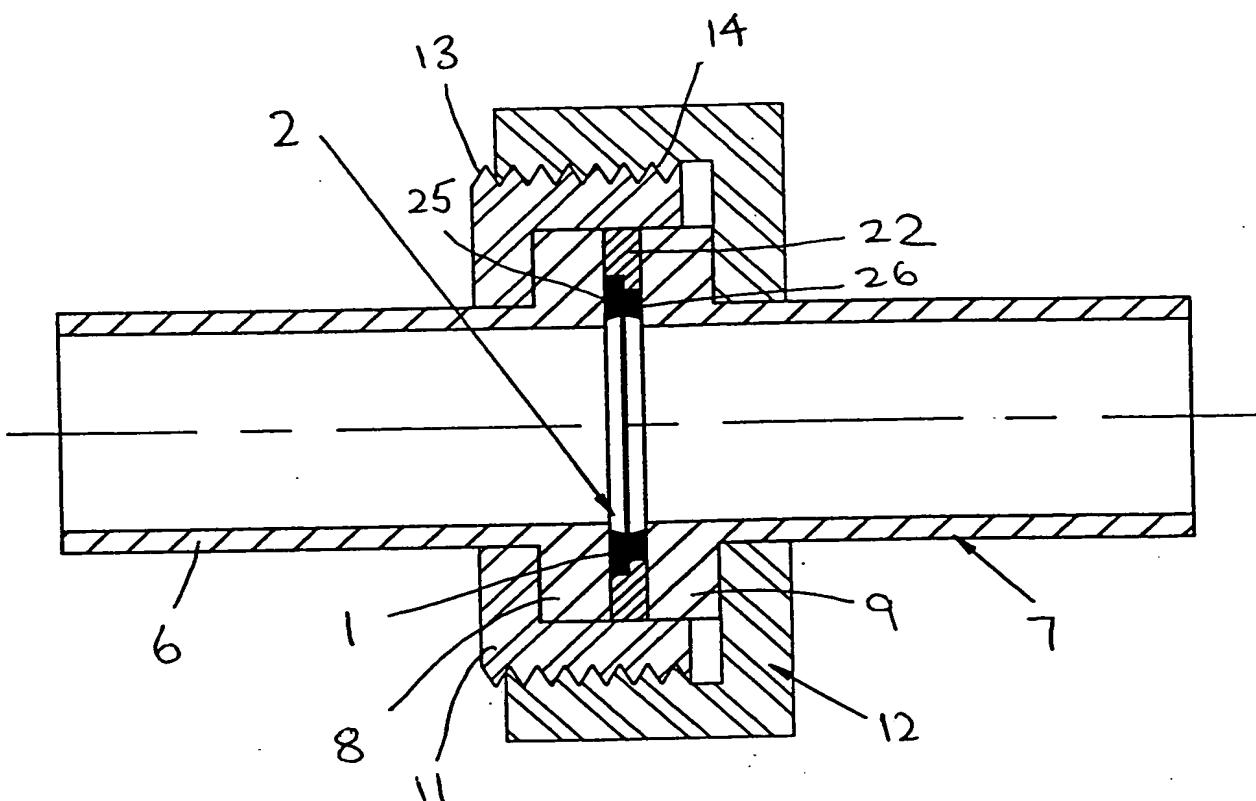


FIGURE 6

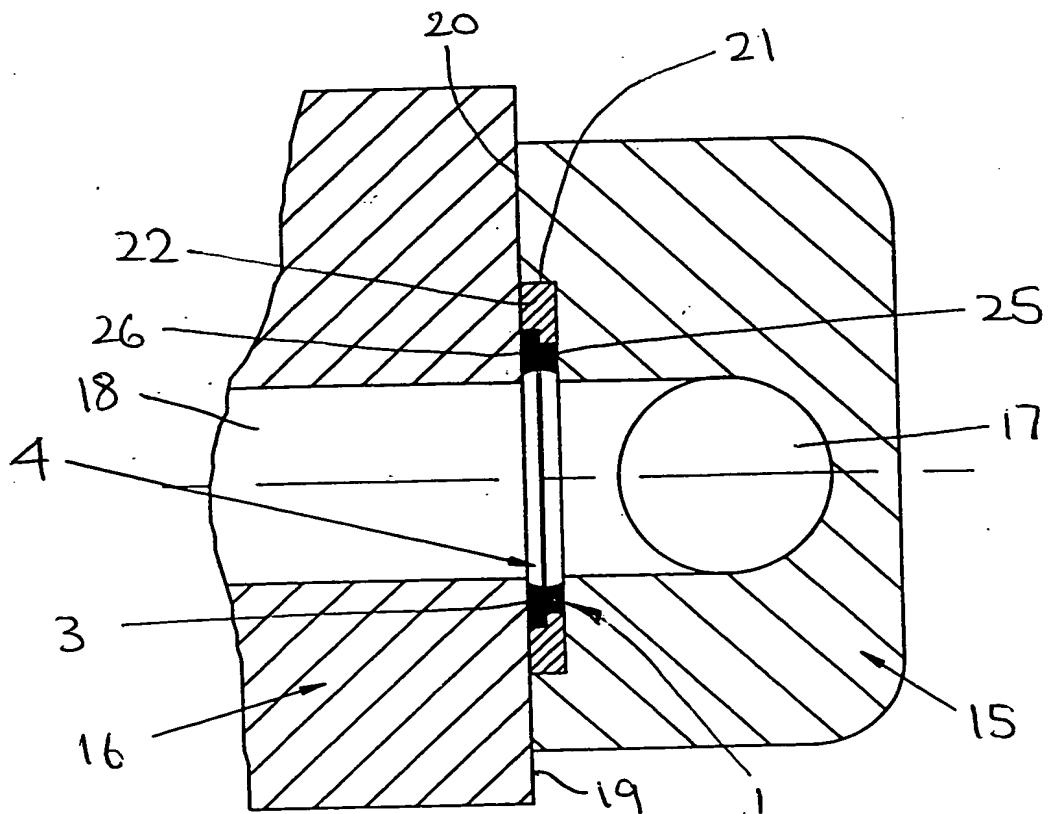


FIGURE 7.

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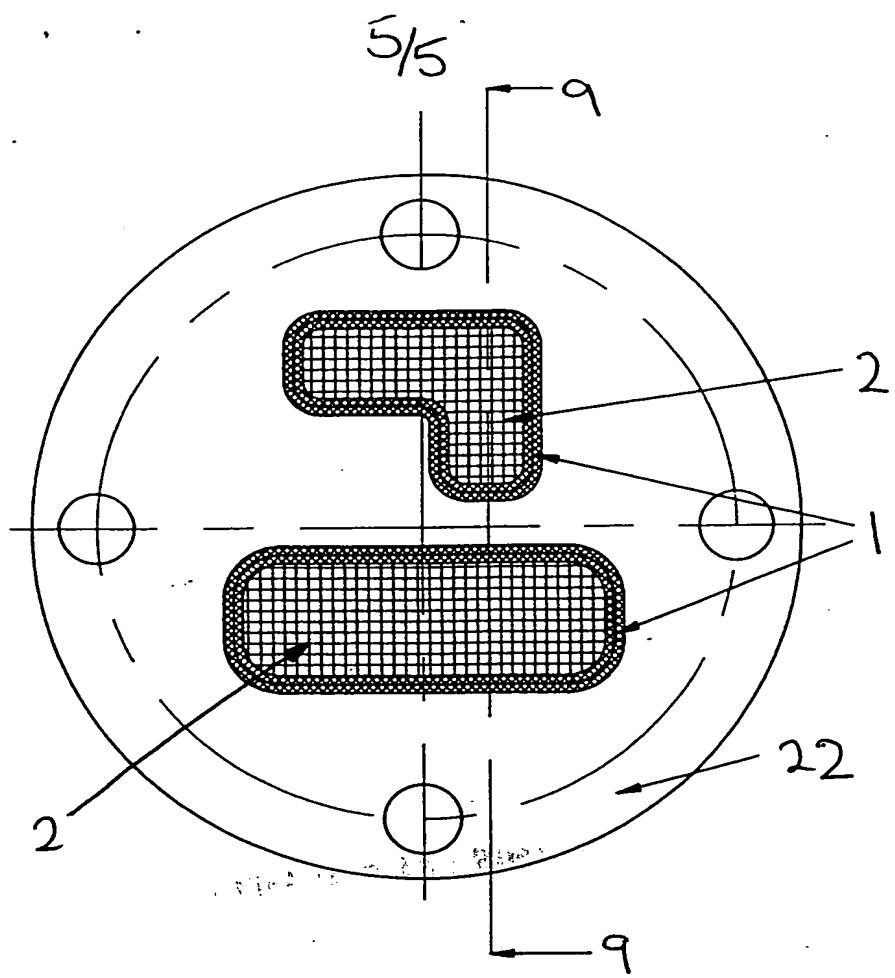


FIGURE 8

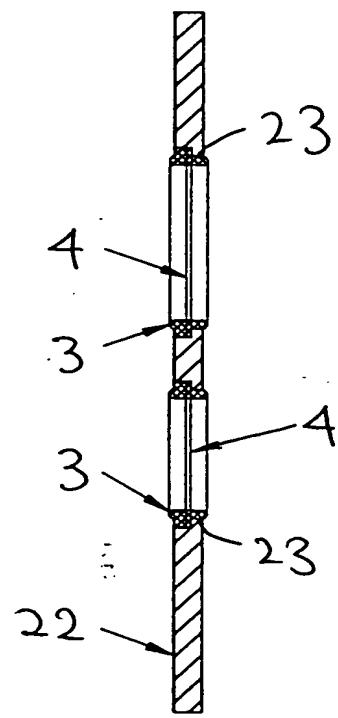


FIGURE 9.

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